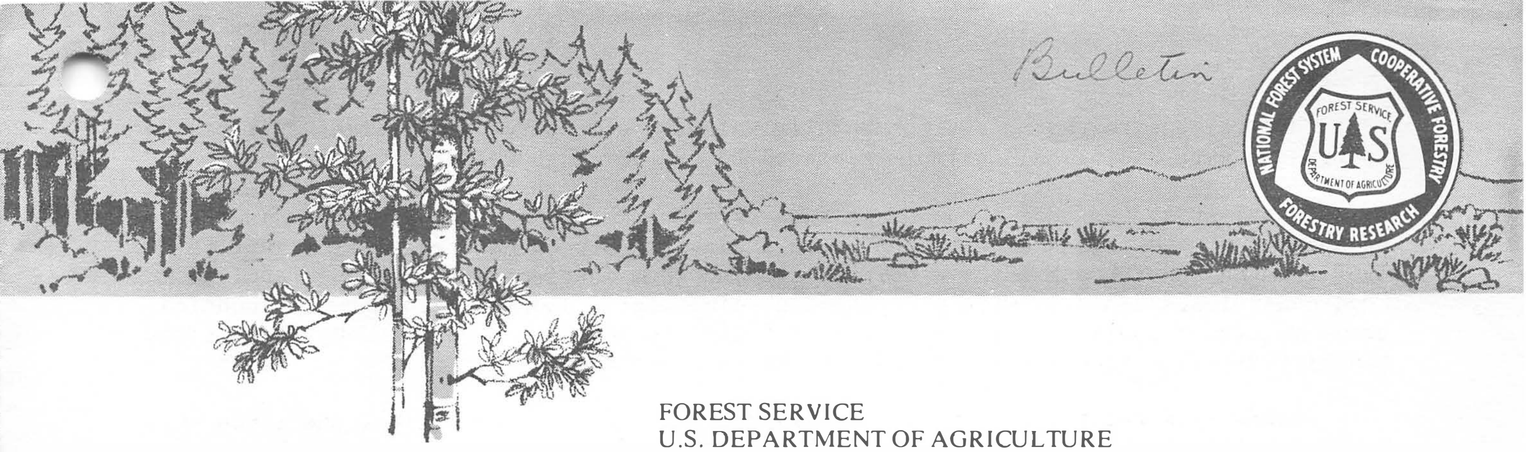

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AN AERIAL TEST OF ORTHENE AGAINST THE LARCH CASEBEARER

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ABSTRACT

The larch casebearer population on test plots in Farragut State Park, Idaho, was reduced an average 97.2 percent by a systemic insecticide, Orthene, sprayed from a helicopter. Tested against the needle mining stage of the casebearer, Orthene was effective when applied at a rate of 1 lb/gal/acre.

KEYWORDS: insecticides, control, larch casebearer, Orthene

The larch casebearer, *Coleophora laricella* (Hbn.), a native of Europe, was discovered on western larch (*Larix occidentalis* Nutt.) in 1957 near St. Maries, Idaho (Denton 1958). Since then, it has spread and now occurs over most of the western larch stands in Idaho. Invasion has extended into Montana, Washington, Oregon, and southern British Columbia. The Forest Service and its cooperators are placing major emphasis on establishing biological control of the larch casebearer through the introduction of several species of exotic parasites. Suppression of larch casebearer by biological control is a long-term goal.

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Chemical control using environmentally safe and effective insecticides that can be integrated with biological control is needed to protect high resource values.

Aerial spray tests of a number of insecticides, including DDT, lindane, dimethoate, phosphamidon, and malathion were conducted against the larch casebearer from 1962 to 1964 (Denton and Tunnock 1968). DDT and lindane were ineffective at dosages applied. Good control was achieved with phosphamidon, dimethoate, and malathion. Only technical grade malathion applied in the spring at 0.6 lb/acre has been registered by the Environmental Protection Agency for use against the larch casebearer.

Orthene[2], a relatively new systemic insecticide, was tested against the larch casebearer in 1974 by the State of Idaho.[3] The results of this test showed that heavy (0.75 lb/100 gal) and medium (0.375 lb/100 gal) dosages effectively reduced the casebearer population on individual trees.

In the spring of 1975, the Insecticide Evaluation research work unit (Pacific Southwest Forest and Range Experiment Station) conducted bioassay tests of Orthene against needle-mining casebearer on larch seedlings. These tests proved the needle-mining stage of the larch casebearer was susceptible to Orthene (Page and others, in press).

A test to determine the effectiveness of Orthene applied aerially on the needle-mining stage of the larch casebearer was conducted at Farragut State Park, Idaho, the fall of 1975. Those participating in the test were Potlatch Forests, Inc., Idaho Department of Lands, Pacific Northwest Forest and Range Experiment Station, and Intermountain Forest and Range Experiment Station.

METHODS

Insecticide Formulation, Application Rates

The insecticide tested was acephate (0,S - dimethyl acetyl phosphoramidothioate) which is sold as Orthene 75-S (Chevron Chemical Company 1973).

Formulation and dosage used in the field test was 1 lb of active Orthene in 1 gal of water applied at the rate of 1 gal/acre. Nigrosine dye was added at the rate of 7.6 g/gal of finished formulation to aid in the assessment of spray deposit. The spray system of the helicopter to be used was checked, calibrated, and cleared the evening before spraying.

Experimental Design

The field test involved application of Orthene from a helicopter at the rate of 1 lb/gal/acre. The test area consisted of six blocks each 20 acres in size. Three blocks, selected at random, were designated to be treated (spray blocks). The other blocks were reserved as checks (check blocks) to determine natural mortality.

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[2] Orthene is a trademark of Chevron Chemical Company. Use of trade or firm names is for reader information only, and does not constitute endorsement by the U.S. Department of Agriculture of any commercial product or service.

[3] Livingston, R. L., and W. Ludeman. 1974. Results of an August 1974 field test of Orthene against larch casebearer. Idaho Dep. Lands, unpubl. rep., p. 8.

Treatments were made with a Bell 47G-3B-2 helicopter using a hydraulic spray system with a 36-ft boom. Thirty-two 8002 flat fan nozzles were mounted on the boom facing forward and down for maximum breakup. Seventy gallons of spray were loaded in the aircraft and used to treat the three 20-acre treatment plots, leaving 10 gal as buffer in the system. Applications were made in 50-ft swaths applied at 45 mi/h, 50 ft above treetops. Guidance was provided by marking the four corners of each plot with a fluorescent panel placed in the tree by shooting a line over the tree with a line-throwing gun and using this to hoist the panel into the treetop.

Within each of the six test blocks, 15 western larch, in an area of 3 acres or less near the center of the block, were selected for measurements of larch casebearer populations before and after spraying. The sample trees were nearly full crowned and did not exceed 35 ft in height. All blocks had an average larch casebearer population of at least 50 larch casebearer/100 fascicles.

Spray mortality counts were corrected for natural mortality using Abbott's formula where:

$$\%\ \text{control} = \frac{\%\ \text{mortality in treatment} - \%\ \text{mortality in check}}{100\% - \%\ \text{mortality in check}}$$

To determine the true effect of treatment on the larch casebearer population, a covariance analysis was run and the larch casebearer population means were adjusted.

The model used was:

$$y = \mu + x_{i} + B(x_{ij} - \bar{x}) + \varepsilon_{ij}$$

where:

μ = mean population

x_{j} = blocks

$B(x_{ij} - \bar{x})$ = covariate

ε_{ij} = error term

The null hypothesis tested was that there was no difference in the true effects among the six blocks. The Duncan Multiple Range Test was used to determine the difference between blocks.

Prespray and Postspray Sampling

Two or three days before spraying, four 18-inch branches were removed from each tree. Each branch had a minimum of 100 fascicles. The tree crowns were divided into 12 parts and each part assigned a number. Four numbers were drawn at random to determine the place from which the samples would be taken. The four branches from a tree were placed in a paper bag and labeled.

The branch samples were taken to the laboratory where they were held in a cooler at a temperature of approximately 36°F. All branches were examined within 4 days of collection. Examiners recorded the number of live larch casebearer on the 100 terminal fascicles for each branch.

The post-spray samples were collected and counted during the first 2 weeks of December after needle shedding ceased. The same procedure was used for selecting the location of branches, except that two branches were removed from each randomly selected crown position, making a total of eight branches per sample tree. Post-spray processing involved examination of overwintering casebearer larvae attached to the branches. The hibernating stage was proof that larvae had escaped the effects of spraying. The number of hibernating larvae on the 200 terminal fascicles of each branch was recorded.

Spray Deposit Assessment

Kromekote spray deposit cards were used to determine dosage per acre and spray droplet size. Two cards were used for each sample tree in all blocks. The cards were placed the morning of spraying in the nearest stand openings and at ground level. They were picked up no later than 2 hours after spraying was completed.

Deposit cards were analyzed by the Aerial Application Group of Pacific Northwest Station to estimate amount of spray deposited and determine the number of drops per square centimeter and the size of drops deposited.

Spray deposit cards were analyzed using an Imanco Quantimet 720 Image Analyzer. The system was set up with an extension tube to read an area of 0.6 cm^2 for three randomly selected areas per card. The system recorded the number of spots per area read, as well as the size of all spots over 20 μ in diameter. A 20-μ spot was formed by a droplet approximately 10 μ in diameter. Utilizing the number of droplets per area and their sizes for each pair of cards, we determined the number of droplets per unit area (number per square centimeter), the average size of the droplets and the volume of spray landing on the cards (expressed as gallons per acre).

RESULTS AND DISCUSSION

Aerial spray operation.--The deposit within the spray blocks averaged 0.34 gal/acre. This total is lower than expected and is assumed to be caused by winds that occurred during spraying. The spray drifted onto the two check blocks (II,VI) that were one-fourth mile downwind of the nearest spray block. Deposit was recorded on all cards placed in these check areas.

Droplet size in the spray blocks was larger than desired, but that measured on the cards from the check blocks II and VI was smaller and close to the desired range (table 1). Check block IV upwind from the spray blocks received no spray deposit.

Population reduction.--The corrected larch casebearer population reduction due to the spray averaged 97.2 percent for the three sprayed blocks (table 2). Statistical analysis showed that the null hypothesis was rejected with a probability level of 0.0001. The Duncan Multiple Range Test showed that larch casebearer population for sprayed blocks I, III, V, and check block VI (the check block that received the most spray drift) was significantly different (5 percent level) from check blocks II and IV.

Table 1.--*Summary of spray deposit measurements and corrected larch casebearer mortality*

Treatment and block	Corrected percent mortality	Volume mean diameter	Gallons per acre	Droplet density per cm^2	Remarks
		μ			
Spray					
I	99.6	330	0.33	5	
III	99.9	306	.47	9	
V	92.1	419	.22	1	
Check					
II	39.1	174	.01	0.7	Light drift
IV	13.5	0	.00	0	
VI	82.2	174	.01	1.0	Drift

Table 2.--*Larch casebearer pre- and postspray population densities, survival rates, and mortality estimates*

Treatment and block	Casebearer density: Prespray treatment[1] Mean	Prespray treatment[1] Standard deviation	Postspray treatment[2] Mean	Postspray treatment[2] Standard deviation	Survival ratio	Corrected percent mortality[3]
Spray						
I	47.19	41.86	0.18	1.24	0.0038	99.56
III	238.68	161.80	.15	.53	.0006	99.93
V	110.52	91.11	7.52	18.90	.0680	92.14
Check						
II	226.17	136.31	119.20	66.07	.5270	39.08
IV	202.87	131.64	175.50	95.48	.8651	13.49
VI	71.30	48.58	11.00	17.37	.1543	82.22

[1]Needle-mining larvae per 100 fascicles.
[2]Overwintering casebearing larvae per 100 fascicles.
[3]Corrected for natural mortality in check block IV.

CONCLUSIONS

Orthene shows promise as an effective insecticide for reducing larch casebearer needle mining populations.

No conclusions can be drawn from deposit-mortality relationships due to the consistently high population reduction in the treated blocks. In this test, larch casebearer population reductions were high in the blocks treated with Orthene. From the mortality that occurred in the two check blocks (II, VI) that received drift, we infer that Orthene even at relatively low concentrations kills larch casebearer.

Although this test was conducted under ideal conditions from the standpoint of casebearer population, sample tree size, access, and terrain, the material was applied under windy conditions. Nevertheless, when applied by helicopter, Orthene proved to be very effective in reducing larch casebearer needle-mining populations. Additional tests are needed to verify the effectiveness of the insecticide applied at the rate of 1 lb/gal/acre against the needle-mining stage of the larch casebearer. That mortality occurred where a light dosage (drift) was deposited would suggest future tests should also include treatments with less concentrated solutions of Orthene.

The large droplet size measured in the spray blocks is probably due to the smaller drops being blown away by the wind and, therefore, should not be taken as a measure of efficiency of the spray system used.

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PESTICIDE PRECAUTIONARY STATEMENT

This publication reports research involving pesticides. It does not contain recommendations for their use, nor does it imply that the uses discussed here have been registered. All uses of pesticides must be registered by appropriate State and/or Federal agencies before they can be recommended.

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